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NORTHEASTERN FOREST EXPERIMENT STATION

Amherst, Mass.

ANNUAL INVESTIGATIVE PROGRAM

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Northeastern Forest Experiment Station

Annual Investigative Program 1931

The Northeastern Forest Experiment Station is one of eleven regional experiment stations maintained by the Forest Service, United States Department of Agriculture to cover all of the principal forest regions of the country. The territory served by the Northeastern station includes all of New England and New York. Headquarters are maintained at Amherst, Mass., in cooperation with the Massachusetts Agricultural College.

The forest experiment stations fulfill the same functions in regard to the development of forest resources and forest industries that the agricultural experiment stations do for agriculture. Altho most of the forest experiment stations have been in existence for several years, a comprehensive program of federal forest research was first authorized in 1928 under the McSweeney-McNary Forest Research Act.

This act outlined the regional set-up of the experiment stations and provided for specific appropriations to cover not only research dealing with the production and protection of forest crops, but also for work in forest pathology, forest entomology, forest biology, forest fire-weather forecasting, range investigations, forest products, forest economics, and a comprehensive survey of forest resources of the nation.

Within the past year, as a result of a growing realization of the importance of forests in relation to water resources, it has been proposed to add another section to the McSweeney-McNary Forest Research Act to provide for an adequate program of investigations on the influence of forests upon stream-flow erosion and water supply.

The Northeastern Forest Experiment Station was established in 1923 with an initial appropriation of $25,000. In 1925 a pathologist from the Bureau of Plant Industry was assigned to this station, and the following year the Bureau of Entomology also assigned a man to the Northeast. In 1930 the force was again expanded by the assignment of a specialist in food habits of birds and rodents from the Bureau of Biological Survey. Except for slight internal adjustments, no change in the initial appropriation for silvical studies has accompanied this expansion in the work of allied bureaus up to the present. For the fiscal year commencing July 1, 1931, however, additional funds have been provided for initiating two new major lines of work in forest management, and the work in forest pathology will be materially expanded by the addition of another technical man to the staff. The total Forest Service appropriation for the coming fiscal year will be $47,900 in addition to funds contributed by the cooperating bureaus.

Altho these developments will greatly increase the usefulness of the station, there are still several important fields which are inadequately covered or not handled at all, so that continued effort will be necessary to expand the work to meet the needs of the region. Up to the present it has been necessary to concentrate studies in forest management on the spruce forests of northern New England and New York. The new work authorized for the present year will extend this to cover the northern

hardwoods which are also found in the northern part of the region, and will make possible a study of forest planting throughout the region. Aside from this, however, no comprehensive studies in the management of white pine or the oak forests of southern New England and New York will yet be possible.

The station's program of forest fire research has also been confined chiefly to the northern part of the region. Because of local climatic conditions, however, the principal zone of fire hazard is in the southern portion of the region. For this reason it would be extremely desirable to extend the fire-weather studies which the station has undertaken in cooperation with various agencies, to the oak forests of Connecticut, the pitch pine type of Cape Cod, and the special conditions of Long Island. Nothing has yet been done on the important problem of the damage done by forest fires. Without intensive studies in this field it is difficult to create in the mind of the public a full realization of the necessity of preventing forest fires and all estimates of fire damage are made in the most haphazard fashion. This may be considered one of the urgent needs of the region at present.

Perhaps the most important line of work demanding attention is that of forest economics. For all the forest types of the region existing technical knowledge is far ahead of the practice of forestry in the woods. The difficulties are largely economic in character. There is practically no authentic statistical information on the amount, quality, or location of timber of various sorts and equally scanty knowledge of regional growth either present or potential. Depletion of the northeastern forests has gone so far that many wood-using industries have moved to other regions. The second growth over much of the region, is of such low quality, woodland ownership is in general so scattered, and manufacture by portable mills so inefficient, that satisfactory markets are hard to find. Local tax situations encourage the liquidation of timber as soon as it reaches merchantable size and discourages the practice of cultural measures to improve the quality of young timber. As a result of all this, there is no public appreciation of the economic value of forest management to the region.

Economic research along three lines should be undertaken as soon as possible to meet this situation. The first of these is a comprehensive survey of forest resources, including not only an estimate of the quantity and location of existing supplies, but also studies of present and potential growth for the region, estimates of rate of depletion, present rate of consumption, and trends in the utilization of forest products.

The second project would have as its objective stabilization of the forest industries in the region. It would involve a complete analysis of the principal industries, covering such topics as organization, financial structure, production and manufacturing methods and technique, marketing, merchandising, and possibilities of cooperation within the industries. This would be a large undertaking, all phases of which should be tackled simultaneously so that the analyses of the various factors involved would be in proper perspective to each other, which would be difficult, if not impossible, were isolated fragments of the whole problem segregated for independent study one after another. Keen interest in a project of this sort has already been indicated by responsible agencies in the region and a definite plan of work awaits the appearance of adequate financing for initiation of the study. Since the

results of work of this sort are fundamental to any progress in the solution of the economic problems of the region, and since funds for the work have not yet been provided elsewhere, it is highly desirable that the federal government assume the leadership in financing the project on a cooperative basis. This may be effectively done by providing an appropriation under Section 10 of the McSweeney-McNary Act for the 1933 fiscal year. This project would be of national interest because it deals with the results of continued unregulated exploitation of forest resources in a region from which the virgin timber has long been exhausted. It should provide a background which will enable other regions with shorter history to develop a more satisfactory and efficient husbandry of their resources.

A third important line of economic study which may be considered independent of those already outlined would aim to show how forest management would contribute to community prosperity in rural districts of the northeast and what the possibilities are of more effectively integrating agriculture and forestry. It would analyze the costs and returns in forestry operations and lay the groundwork for more widespread practice of forestry on private lands. This work ties in closely with land utilization studies in progress at some of the state agricultural experiment stations now and should be undertaken under Section 10 of the McSweeney Act next year if cooperation to make possible the industrial study outlined above does not materialize or in the event that funds to handle the latter without federal aid should be forthcoming.

Forest Research Council

The Northeastern Forest Research Council, organized by the Secretary of Agriculture to assist the station in the formulation of its program, and to coordinate and stimulate forest research by all agencies in the region, has held three meetings since the last annual report. In February 1930 a meeting was held in Springfield, Mass. Forest Entomology was made the primary topic of discussion at this meeting and entomologists from most of the states in the territory were present to tell of their work and of problems needing attention. Considerable discussion was also devoted to ways and means of keeping the public better informed of the work of the station and its needs.

The Council gathered at Waterville, N. H. during July 1930 for a field meeting. Trips to a number of experimental areas on which the station has been working for several years and to areas recently cut-over on a national forest timber sale proved interesting and instructive. These trips, supplemented by a talk by Forest Supervisor Scott, gave the Council a clear picture of several phases of National Forest Administration. The discussion at the business session centered around the desirability of bringing the national survey of forest resources to the Northeast at an early date and brought out a number of projects already in progress or proposed by other agencies in the region which would tie in closely with the forest survey. Considerable time was also given to the need for studies of forest planting in the Northeast.

Early in February, 1931, the regular winter meeting of the Council was held in Albany, N. Y. The morning session was devoted to a discussion of Research in Forest Planting under way by various agencies in the region from the standpoint of

coordination of all these activities. This resulted in the appointment of a committee which will aim to bring all agencies engaged in planting studies together in a unified program of research for the region. The work of this committee will also be of great value in assisting the experiment station to formulate a most effective working plan for the attack on the planting problem which it will initiate this summer. The field of economic research in forestry was the subject for the afternoon session. This session was open not only to a number of guests specially invited to the meeting, but to the staff of the New York Conservation Department and others. The following papers were read at this meeting:

"Forestry and Industrial Development in New England," by Dudley Harmon, executive vice-president, New England Council, Boston, Mass.

"The Farmer and his Woodlot," by E. H. Thomson, President, Federal Land Bank, Springfield, Mass.

"The Utilization of Sub-Marginal Farm Lands in New York," by C. E. Ladd, Deputy Conservation Commissioner, Albany, New York.

"Wood Utilization Survey for New York," by G. W. Sisson, Jr., President, Racquette River Paper Co., Potsdam, New York.

"A Plan for Economic Studies of the Lumber Industry in the Northeast," by R. T. Fisher, Director, Harvard Forest, Petersham, Mass. (in absentia).

"Economic Research Program of the U. S. Forest Service," by R. E. Marsh, U. S. Forest Service, Washington, D. C.

Experimental Forests

An allotment under the federal emergency unemployment relief program and increased appropriations for the fiscal year beginning July 1, 1931 will make possible substantial development of the two experimental forests in the White Mountain National Forest this year.

Work is already in progress on the construction of about 3 miles of permanent light duty motor roads on the Gale River Forest, and more than 4 miles of similar road on the Bartlett Area. Altho present allotments do not permit full realization, the objective of the road building program is to place all parts of the experimental forests within one quarter mile of a permanent road. With these roads completed it should be possible to dispose of some material each year in the form of experimental cuttings. The construction of these roads will also make possible final division of the experimental forests into compartments for management purposes. It is, therefore, planned to make a complete inventory of both forests by compartments during the coming season.

Another feature of the plans for the Bartlett Area is an intensive survey of conditions on those portions of the forest on which fuelwood and bobbin cuttings have been made during recent years. This should give much valuable information concerning reproduction and growth of northern hardwoods after selective logging, and will contribute materially toward the project dealing with northern hardwoods for which new funds are expected this summer. The inauguration of the new study of growth and yield of northern hardwoods will also make possible the establishment of a number of permanent sample plots for studying the effects of experimental operations on the Bartlett Forest.

Jensen will be in charge of the Bartlett Area which will be developed primarily to exemplify the management of northern hardwoods, and will spend a large part of the year on this forest. Westveld will be in charge of the Gale River Forest and will aim to develop the area primarily for softwood pulp production. On both experimental forests it is planned to establish permanent stations for measurement of meteorological conditions. Instruments for this purpose will be released by completion of field work on the fire-weather project.

As a result of administrative reorganization of the White Mountain National Forest, well equipped ranger stations can be made available for use of the experiment station at both Bartlett and Twin Mountain as soon as activities justify keeping a man permanently on these areas. Meanwhile the guard station on the Gale River area will be made more satisfactory for summer quarters.

Further survey work during the coming season will be necessary before the Bartlett area can be formally designated as an experimental forest in accordance with the regulations. The area to be retained will be confined to that portion of the basin tentatively set aside in 1927 which lies north of the Passaconaway automobile road and west of Bartlett Brook.

With the formal approval of a national forest purchase unit in southern Vermont the way is opened for selection on an experimental forest in that section which is typical of the southern extension of the northern hardwood type as represented over large areas in Vermont, southern New Hampshire, western Massachusetts, eastern New York, and northwestern Connecticut.

Natural Areas

A number of possibilities suggested as natural areas representative of the spruce-hardwoods type were examined during the past year. The most likely area thus far inspected lies in a deep basin on the east side of Mt. Whiteface, reached from Wonalancet on the southern boundary of the White Mountain Forest. This area contains excellent examples of virgin condition ranging from pure northern hardwoods, through various mixtures of spruce and hardwoods, to pure spruce on the upper slopes. It comprises a natural unit the reservation of which would in no way interfere with development of other portions of the forest. A walk of about two miles is necessary to reach the area from the end of the automobile road. Since there is no danger of sales being negotiated in this area, final decision is being postponed pending an opportunity to examine other prospective area tributary to the Swift River and adjacent to the Bartlett Experimental Forest.

Administrative Research

During the past year the White Mountain National Forest has initiated, as part of a program for all of Region 7, systematic surveys of conditions following logging on various timber sale areas. The field work consists of running transects through typical areas, and studying the residual stand and reproduction in accordance with a set plan. Certain strips are permanently marked for future remeasurement. Copies of the reports on these surveys are furnished the experiment station. The survey of the cut-over areas on the Bartlett Experimental Forest will be done in a more intensive manner in cooperation with the Experiment Station during the summer of 1931.

The experiment station was invited to participate in a trip to study logging and reproduction conditions on the steep upper slopes of the White Mountain National Forest. Several areas in the Waterville Valley were carefully inspected and a number of controversial points cleared up. Advice of the experiment station was also sought in outlining the details of the working plan for the new management survey of the White Mountain National Forest which was initiated during the summer.

At the request of the Washington office the experiment station made contact with the lightning arrester research division of the General Electric Company and in cooperation with the White Mountain National Forest made some preliminary tests under field conditions of the suitability of a new material, known as "Thyrite," for the protection of telephones against lightning.

Cooperation

In addition to the various contacts with the White Mountain National Forest mentioned in the previous paragraphs, most excellent cooperation is now effective in the execution of the road construction and improvement program for the experimental forests under the emergency unemployment relief measures. The National Forest has taken over the entire job of handling this work, looking to the Station only for instructions as to location and character of work to be done.

Cooperation with the Massachusetts Agricultural College continues on the same satisfactory basis as heretofore. A change in personnel in the forestry department of the college bids fair to result in more aggressive development of the college demonstration forest on Mt. Toby. A complete management inventory of this forest, in which the experiment station will cooperate, is planned for the spring of 1931. During the winter quarter Stickel again gave a three hour lecture course in Forest Ecology to advanced students in the horticultural department of the college. In order to provide adequate quarters for the station entomologist and biologist, the college made certain alterations in French Hall where the station is housed. The need for additional quarters to take care of the enlargement of the station force which will become effective July 1, 1931, is receiving consideration by the college and will probably be met by providing additional space in French Hall for the new men in management studies and in Clark Hall, where Doctor Spaulding is now located, for the increased needs of the Bureau of Plant Industry.

The New York State College of Forestry extended its cooperation in the fire weather project to speed up the analysis of the field data, and has agreed to publish the report for the Cranberry Lake Station this year as a College Bulletin. Cooperation from the Harvard Forest, the Maine Forest Service, Finch Pruyn and Company, and the New York Conservation Department was again extended to complete the field observations at the three other fire weather stations.

The fire weather forecast service of the Weather Bureau has been continued with cooperation from the station in furnishing daily reports during the season from the Elk Lake, New York, and Smyrna Mills, Maine, stations. With the completion of field work at the fire weather stations, cooperation will now take the form of supplying calibrated duff hygrometers to field men at points selected by the state foresters and the Weather Bureau.

Cooperation with the Bureau of Plant Industry will be on an enlarged basis after July 1, 1931, when additional appropriations become available for studies of rots of forest trees in the Northeast.

The Bureau of Entomology has continued its work in the Northeast on the same scale as heretofore, but Doctor MacAloney has again taken up headquarters at Amherst. In further cooperation with the Bureau of Entomology, the station has been engaged during the past year in remeasurement of a number of experimental areas established in 1914 and 1915 for study of the control of the Gypsy Moth by forest management. A cooperative report presenting the results of the work on these plots will be published in 1931 and the plots will then be turned over to the experiment station for whatever further use may be made of them. V. S. Jensen has been in charge of this work.

Cooperation with the Biological Survey was initiated during the past year by the assignment of J. Paul Miller to the station for studies on the relation of various forms of vertebrate life to the white pine weevil.

An increasing amount of time of the specialists from these cooperating bureaus will be required for inspection of permanent sample plots maintained in connection with the various management projects and for survey of conditions on the experimental forests. The survey of plantations to be undertaken in the summer of 1931 will also call for a certain amount of cooperation from the station pathologist, entomologist, and biologist.

A new line of cooperation was initiated during the past year with Finch, Pruyn and Company, and the Forestry Department of Cornell University in connection with some methods of cutting experiments in pulpwood timber near Newcomb, New York. The experiments involve detailed survey followed by logging on an area of about 120 acres belonging to Finch Pruyn and Company. The boundary and topographic survey work, the marking and the cutting are being handled by Finch, Pruyn and Company. The experiment station participated in the marking, had charge of the tally of saplings and reproduction, and will handle the remeasurement after logging and analysis of the data. Cooperation in the field work of tallying the stand and reproduction is provided by the senior class of the Forestry Department of Cornell University, which maintains a summer camp nearby. The Department of Forest Soils at Cornell is also participating in studying the changes of conditions which follow the experimental cuttings.

Status of Investigations

Management. Spruce and Northern Hardwoods Region

Up to the present the Northeastern Forest Experiment Station has devoted its attention primarily to problems in the management of the spruce types in the northern part of the region. One of the first phases of the subject to be taken up was the question of rate of growth and yield for the species involved. Normal yield tables for red spruce, white spruce, and balsam fir were prepared by W. H. Meyer and published in 1929. Some attention has been given to the application of these tables to understocked stands, but it has not yet been possible to take up the study of the

growth and yield of uneven aged stands of spruce and fir in mixture with hardwoods. Intensive study was also given to the question of taper in these species and the variations in form which they exhibited under diverse growth conditions. These studies conducted by C. E. Behre have contributed materially to an understanding of the factors affecting the accuracy of estimates of volume of trees and stands. Because of changes in personnel little progress has been made with this work in the past three years, but a report should be ready for publication during the ensuing year and follow up of certain phases of the project will be carried on in an incidental manner as time permits.

Simultaneously with the projects in the field of mensuration just outlined, studies to determine the best methods of cutting to insure reproduction and optimum growth in the spruce types were undertaken. M. Westveld was placed in charge of this work and has devoted himself continuously to it for the past seven years. Intensive study of specially treated sample plots has been supplemented by inspection of cut-over areas and logging operations under widely diverse conditions in all parts of the region. An area on Cherry Mountain, in the White Mountain National Forest, cut over in 1925, has served as a center for much of the intensive work on this project. Another center of work has been in the Waterville Valley, also on the White Mountain Forest and intensive study of a new area was initiated during the past year near Newcomb, N. Y. Permanent plots are also under observation at other points in the region.

The study shows that spruce stands in the region are normally well stocked with advance reproduction of softwood species. Observations have been made on the extent to which this advance reproduction is damaged or destroyed by logging, on the relation of logging slash to the development of the reproduction, on the severity of the competition from brush growth and encroaching young hardwoods, and on the variations in these factors caused by differences in the composition of the original stand and the method of cutting employed. Intensive study is being given to the conditions favoring the germination and survival of seedlings of spruce and fir. This is being done by sowing seed on a large number of milacre quadrats under all sorts of conditions and following the result through a number of growing seasons.

Since successful management of spruce stands lies primarily in preserving and developing the young growth already established at the time of cutting, attention has been given to cultural methods to stimulate this advance growth. Experiments on the value of weeding, or cutting back of hardwood and weed growth, in the first few years following logging have been initiated and extensive study has been given to the results of girdling worthless hardwoods left overtopping the softwood advance growth in most commercial logging operations. Remarkable stimulation of softwood growth has been demonstrated from these girdling experiments and this applies equally to spruce and fir of merchantable size as it does to small reproduction. One of the next phases of these spruce management studies in need of attention is thinning in young stands.

A large amount of data has been gathered on the growth of spruce and fir after logging, but it has not yet been possible to analyze this thoroughly. Many of the areas studied in 1924 and 1925 were remeasured during the past year and some of this material has been made available for study by John C. Sammi, of the New York State

College of Forestry, who will issue a preliminary report this year. Follow up of this phase of the project will receive considerable attention in 1931 when an attempt will be made to relocate and remeasure many of the plots previously studied in Maine.

Another phase of fore t management in the spruce types of the Northeast which has been given special attention is that of slash disposal. The effect of slash of various species on establishment and development of young growth following logging, the character and duration of the fire hazard which the slash presents and the best method of handling the slash are important questions to the timberland owner. Final answers to the many questions involved in slash disposal must depend on adequate knowledge of the rate of decay of slash of various species under different conditions. For this reason Doctor Perley Spaulding, the station pathologist, and Mr. Westveld are working together on this project. Since exposure is known to be an important factor in decay of slash, experimental plots have been laid out in stands of similar character but on slopes exposed in different directions. Altho decay on the recently established plots is just getting into full sway, several important points have already been established. Water-logging has been shown to be an important factor in limiting the progress of decay and it has been possible to recommend definitely discontinuing the lopping of hardwood slash on national forest timber sales.

Three publications on the management of spruce have recently been issued. These are Leaflet 57, "Pulpwood Crops in the Northeast," Circular 134, "Suggestions for the Management of Spruce Stands in the Northeast" and Technical Bulletin 223, "Reproduction on Pulpwood Lands in the Northeast."

Perhaps the most important development in the spruce management project during the past year was the establishment of a series of permanent plots covering about 150 acres on the lands of Finch, Pruyn and Company, and the State of New York in the Adirondack Mountains. The object of these plots is to study the possibility of conducting the logging for pulpwood in such a fashion as to permit successive operations on the same area at intervals of about thirty years. If this can be done much of the growth of balsam fir, which usually rots and blows down between logging operations at longer intervals, could be utilized.

As a by-product of these experiments, a new project in forest pathology is added to the station program for the coming year. This involves a study of the rots concerned in the decay of balsam, the methods of infection, rate of spread, and conditions under which trees are most subject to decay. From this work it should be possible to state from a pathological standpoint how long a period may be allowed between logging operations without undue loss.

Another outgrowth of spruce management project has been the study of the decadence of birch following logging which has been given attention during the past season by the station entomologist, Doctor H. J. MacAloney, and the pathologist, Doctor Perley Spaulding. Throughout the region it was noted that both white and yellow birch left after logging in the spruce-hardwood types very commonly lost their vigor and died back from the tops. At first it was supposed the trouble was primarily caused by the bronze birch borer, an insect thought to be favored by opening up of the stand. Further study indicated that certain root fungi, whose activities might also be stimulated by the cutting operations, might play an important part in the

problem. Careful examination of several hundred trees under varying conditions and excavation of the entire root system of a few selected specimens failed to indicate any primary trouble from either the insects or the fungi. It appears, therefore, that the decadence of birch must be the result of inability of the species to adapt itself to the radical change in environment brought on by the logging operations. The problem must now be studied from a physiological standpoint and it is planned to give it some further attention during the coming year.

Funds which will become available July 1, 1931, will make it possible to extend the station's activities in the northern portions of the region to the northern hardwoods which, altho often associated with the spruce and fir have thus far been given only incidental attention. It is proposed to undertake a comprehensive study of the growth and yield of the northern hardwoods this summer.

Fire

Protection of the forests from fire is generally recognized as a prerequisite for the development of forestry along other lines. For this reason early in its history the Northeastern Forest Experiment Station began a series of studies with the objective of providing an accurate picture of the effectiveness of the protective organizations, of defining relative hazards in different parts of the region, and of supplying dependable means of knowing when conditions were becoming dangerous.

Records of fires in Maine, New Hampshire, Vermont, and Connecticut, over a period of years prior to 1926, have been analyzed as to causes, location, size, cost of suppression, etc. Specific suggestions as to points toward which special attention should be given by the state organizations have been made as a result of these studies. Mr. S. T. Dana had charge of this project. Final reports on two of the states and a summary for the region as a whole have been delayed as a result of Mr. Dana's resignation, but these are expected to be ready for publication in the near future. The states concerned have provided financial cooperation for this work.

Cumulative analysis of fire records in this fashion will be of increasing value as the basis for timber insurance in the future. However, since the chief value of this sort of work is of an administrative character, compilation of fire statistics might well be done by the state protective organizations themselves. The experiment station may be able to render real service in this field by providing one man to devote his entire time to it, cooperating with workers in each state organization in analyzing currently the fire records for each year and assisting in carrying the results of such studies back to the field force.

In order to learn the relationship between weather conditions and fire hazard complete records of meteorological conditions and of moisture content of the duff on the forest floor through which fires must burn, have been secured at four stations over a five-year period. These records were made possible by cooperation from various agencies in the region and the location of the stations was in large measure governed by the source of cooperation. Stations were maintained at Cranberry Lake, N. Y. in cooperation with the New York State College of Forestry; at Elk Lake, N. Y. in cooperation with Finch, Pruyn and Company and the New York Conservation Department; at Smyrna Mills, Maine, in cooperation with the Maine Forest Service; and at Petersham,

Massachusetts, in cooperation with the Harvard Forest. All of these stations except the one at Harvard were in the spruce region, and the latter was in white pine. he report for the Cranberry Lake Station is completed and being put into shape for ublication. Reports on the other stations will follow as rapidly as Mr. P. W. Stickel, who is in charge of the project, can handle the large amount of work involved in analysis of the data.

At Cranberry Lake duff moisture content is most closely associated with evaporation, number of hours since last rain, and temperature. Zones of inflammability have been worked out and the danger from firebrands of various sorts correlated with the moisture content of these zones.

At the same time these studies have been going on the Weather Bureau has been attempting to include fire weather warnings in its regular daily forecasts and has assigned to Mr. T. E. Reed the task of studying the factors involved and building up the background for such forecasts. Reports from two of the fire weather stations as well as a score of other special stations throughout the region are telegraphed to the central offices daily. Telegraphic forecasts are dispatched to the various state foresters whenever conditions appear dangerous. The study of the relation of moisture condition of the forest fuels to weather conditions provides a basis for interpreting these fire weather forecasts in terms of actual burning conditions.

Other Projects

The white pine weevil constitutes one of the most serious problems to be met in the growing of white pine in the Northeast. Doctor H. J. MacAloney has devoted his major attention to study of this insect since his assignment to the experiment station in 1926. It appears that the most satisfactory protection against the weevil is obtained when white pine is grown in mixture with other species, especially hardwoods. Direct control proves costly and is only practical on the best sites in regions not subject to heavy reinfestation. During the past year encouraging results in the treatment of badly weeviled plantations of white pine to bring through a satisfactory number of the straighter stems has been secured in cooperation with the Harvard Forest. No success has been met in preliminary attempts to find a bait which would attract the insects into traps. Special study is being given to the effect of winter conditions on the survival of the weevils and to the effect of surface vegetation on hibernation.

Since in nature the population of any species is held in check by a balance n its relation to other species and conditions of the environment, there is some prospect of aiding in the control of the white pine weevil through a better understanding of its relation to birds, rodents, and other vertebrates. Mr. J. Paul Miller, of the Biological Survey, was assigned to the Northeastern station last summer and is applying himself to this problem. His work during the next year will be concentrated largely on the Mount Toby Demonstration Forest and the Harvard Forest in Massachusetts.

Throughout the Northeast a tremendous area of abandoned farm land has accumulated in the past few decades. Much of this is in need of reforestation and planting activities have been in progress in all states for a number of years. Within

the past year, however, New York has embarked on a reforestation program on a scale much larger than anything hitherto attempted in this country. This focuses attention sharply on the need for more adequate information on all phases of the planting problem. The station will undertake a comprehensive survey of the planting situation in the Northeast this summer with new funds provided for the purpose and this will be followed by more intensive investigation of special problems as the need becomes clear.

Through the cooperation of a large number of individuals and institutions the experiment station has undertaken to accumulate phenological data for a selected list of forest trees, shrubs, and secondary vegetation. These observations cover time of leafing, flowering, fruiting, etc., and are of interest in relation to almost every branch of scientific forestry work. As a result of preliminary reports for the season of 1930 a more thoroughly coordinated handling of the work will be possible in 1931. Significant results from a project of this sort cannot be expected until records for five years or more have been accumulated.

In addition to the lines of work briefly outlined above the station also has under way a number of other minor projects. These cover a wide range of subjects in the fields of the various cooperating bureaus. In the field of forest management they are concerned chiefly with maintaining a considerable number of sample plots not associated definitely with the projects already described. The principal subjects included are Replacement of Chestnut, Management of Sprout Hardwoods, Management of Eastern Hemlock, Management of Northern White Pine, Miscellaneous Forest and Shade Tree Insects, White Pine Blister Rust, and a number of studies of diseases of forest trees.

Project Summary

Altogether there will be 28 active projects on the program of the station for the coming year. Eleven of these are either dormant or will require only incidental attention, and another six require only current work to maintain observations extending over a period of years. This leaves only eleven projects of major importance for the ensuing year.

The following is a list of the projects and their assignment classified as to lines of work:

MAJOR PROJECTS

Forestation:

*Forest Planting (F-1).

Management:

Methods of Cutting and Reproduction in Spruce (Mc-1). Westveld
Slash Disposal (Mb-1). Westveld and Spaulding

* New projects.

Mensuration:

Development of Universal Taper and Volume Tables (ME-1). Behre
*Growth and Yield of Northern Hardwoods (ME-3). Behre and Jensen

Protection:

Weather and Fuel Relationships (Pf, B-5). Stickel
Prediction of Fire Weather (Pf, C-7). Reed
*Rots of Balsam Fir Pulpwood Timber (Pd-7). Spaulding
Control of White Pine Weevil (Pi-4). MacAloney
*Relationship of Vertebrate Animals to the Growing of White Pine. Miller.
Control of the Bronze Birch Borer (Pi-6). Spaulding and MacAloney

MINOR PROJECTS

Botany:

Phenological Observations of Trees and Shrubs in the Northeast (B-Phenology). Stickel

Management:

Management of Sprout Hardwood Stands (M-2). Westveld
Replacement of Chestnut (M-3). Stickel
Management of Eastern Hemlock (M-4). Behre
Growth, Development, and Management of Northern White Pine (M-6). Jensen
Practice of Forestry by Private Owners (M-1, WO). Staff

Mensuration:

Growth and Yield of Spruce and Balsam Fir (ME-2) _____
Regional Yields (ME-1, WO). Staff
Converting Factors (ME-2, WO). Staff
Manual of Field Methods (ME-4, WO) Staff

Protection:

Analysis of Forest Fire Statistics (Pf, D-2)	Dana
Chestnut Blight (Pd-1)	Spaulding
White Pine Blister Rust (Pd-2).	Spaulding
Pitch Pine Blister Rust (Pd-3).	Spaulding
Shade and Ornamental Tree Diseases (Pd-5).	Spaulding
Miscellaneous Forest Tree Diseases (Pd-6).	Spaulding
Miscellaneous Forest and Shade Tree Insects (Pi-7).	MacAloney

Several changes in the list of projects need special explanation. Four new major projects have been added to the list. That dealing with "The Relationship of

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* New projects.

Vertebrate Animals to the Growing of White Pine" was commenced by the Biological Survey last fall. The other three are to be initiated during the summer of 1931.

Project M-5, Maintenance of Permanent Sample Plots, which formerly appeared in the program has been dropped. Some of the old plots which up to the present have not been assigned to any specific project will now be incorporated into the new projects on planting and growth and yield of northern hardwoods. Others have been assigned to the minor projects on management of sprout hardwood stands or replacement of chestnut, subjects toward which they may logically contribute. The balance still unaccounted for which deal primarily with white pine have been placed together under the new designation M-6, Growth, Development, and Management of White Pine. It should be emphasized that these changes have been made solely to present a logical picture of the work of the station, and that it will not be feasible to do any more intensive work than in the past with the old permanent sample plots not directly associated with major projects.

Minor Project Fs, d-1, Source of Seed, Scotch Pine, has been dropped from the list as an independent undertaking as the four small plots which formed the basis for this project will now be incorporated in major project F-1, Forest Planting.

Project T-1, Relation of Radiation and Soil Moisture to Tree Growth has been dropped because Doctor Gast is continuing his work at the Harvard Forest without any further connection with the experiment station.

Projects ME-2, Growth and Yield of Spruce and Balsam Fir; Pf, D-2, Analysis of Fire Statistics; and Pd-2, White Pine Blister Rust, have been designated as minor rather than major projects since the work on these projects has been reduced to an incidental character.

Permanent Sample Plots

The number of permanent sample plots now being maintained by the Northeastern Forest Experiment Station is 331 involving a total area of over 373 acres. The number reported in 1930 was only 174 covering an area of 77 acres. The large increase is due chiefly to the following causes:

1. As part of Project Mc-1, 57 small plots in New York, totaling 7.13 acres established in 1924 and 1925 as temporary plots for the study of growth and reproduction on cut-over lands, were remeasured in 1930 and added to the list of permanent plots.

2. The experiment station has taken over the areas established in 1913 and 1914 for study of control of the Gypsy Moth by forest management. On these areas 95 plots totaling 87.08 acres have been added to the permanent list. Most of these are extensive in character, the record being in the form of stand tallies without identification of individual trees. On a few selected acres, however, intensive plots were established in 1930.

3. During the past year a series of ten extensive plots of 5 acres each was established in the White Mountains, New Hampshire, and another group of 5 large plots of about 30 acres each was established in the Adirondacks, New York, for the study

of methods of cutting in spruce and northern hardwoods. These are in line with the station's new policy of conducting experiments of this sort on extensive plots with intensive study of smaller areas within these.

The plots are distributed among the states as follows

	No. Plots	Total Area
Maine	27	29.29
New Hampshire	136	140.14
Vermont	37	10.42
Massachusetts	40	28.80
Connecticut	29	7.28
New York	62	157.13
Total	331	373.06

M.1

Gale Reserve - Thurston '32 4 1.00
Mc '32 4 1.00
Bradley - E.P. - '32 2 10.00
Bolton '31 1 11.00
ME-3 - Bartlett Thurston '32 2 1.00
Yield '32 37 9.25

M.1 - Growth on Cut Over.
1931 - 20 2.50
1932 - 11 1.38 -
Planting - Brownfield '33 36 9.00
Monmouth, Me '33 48 12.00
Scotch Pine '32 9 9.00

505 430.19

Additions up to July 1. 193

Pi.3 - Weevil Plots 40 7.00

545 437.19